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IS 13630-8 (2006): Ceramic Tiles - Methods of test, Sampling and Basis of Acceptance, Part 8: Determination of chemical resistance - Glazed tiles (see IS 13630 : Parts 1 to 15) [CED 5: Flooring, Wall Finishing and Roofing]



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Bhartḥari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 13630 (Part 8) : 2006

भारतीय मानक
सिरैमिक टाइलें - परीक्षण पद्धतियाँ,
नमूने लेने तथा स्वीकार्यता का आधार
(पहला पुनरीक्षण)

Indian Standard

**CERAMIC TILES — METHODS OF TEST,
SAMPLING AND BASIS FOR ACCEPTANCE**

(First Revision)

ICS 91.100.23

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (Parts 1 to 15) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in various parts in 1992-93. This is the first revision; having all parts combined in one publication, of the standard in which the following major changes have been incorporated:

- a) As per the decision taken in the last meeting, the requirements of all the parts have been included in one volume and the revised standard has been brought in line with ISO 10545 (various parts).
- b) The requirements for determination of bulk density have been added in Part 2 and a few changes have been made in the requirements for determination of water absorption.
- c) A few modifications have also been made in Part 3.
- d) Requirements for determination of breaking strength have also been added in Part 6.
- e) Requirements for determination of glazing resistance tests have also been modified in Part 9.
- f) A new test for determination of impact resistance by measurement of co-efficient of restitution has been added as Part 14.
- g) IS 13711 : 1993 'Sampling and basis for acceptance' has been amalgamated with Part 15 of this standard.

In formulation of this standard considerable assistance have been derived from the following standards:

- ISO 10545-1 : 1995 Ceramic tiles — Part 1 : Sampling and basis for acceptance
- ISO 10545-2 : 1995 Ceramic tiles — Part 2 : Determination of dimensions and surface quality
- ISO 10545-3 : 1995 Ceramic tiles — Part 3 : Determination of water absorption, apparent porosity, apparent relative density and bulk density
- ISO 10545-4 : 2004 Ceramic tiles — Part 4 : Determination of modulus of rupture and breaking strength
- ISO 10545-5 : 1996 Ceramic tiles — Part 5 : Determination of impact resistance by measurement of coefficient of restitution
- ISO 10545-6 : 1995 Ceramic tiles — Part 6 : Determination of resistance to deep abrasion for unglazed tiles
- ISO 10545-7 : 1996 Ceramic tiles — Part 7 : Determination of resistance to surface abrasion for glazed tiles
- ISO 10545-8 : 1994 Ceramic tiles — Part 8 : Determination of linear thermal expansion
- ISO 10545-9 : 2004 Ceramic tiles — Part 9 : Determination of resistance to thermal shock
- ISO 10545-10 : 1995 Ceramic tiles — Part 10 : Determination of moisture expansion
- ISO 10545-11 : 1994 Ceramic tiles — Part 11 : Determination of crazing resistance for glazed tiles
- ISO 10545-12 : 1995 Ceramic tiles — Part 12 : Determination of frost resistance
- ISO 10545-13 : 1995 Ceramic tiles — Part 13 : Determination of chemical resistance
- ISO 10545-14 : 1995 Ceramic tiles — Part 14 : Determination of resistance to stains
- ISO 13006 : 1998 Ceramic tiles — Definitions, classification, characteristics and marking

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***CERAMIC TILES — METHODS OF TEST,
SAMPLING AND BASIS FOR ACCEPTANCE****PART 8 DETERMINATION OF CHEMICAL RESISTANCE —
GLAZED TILES***(First Revision)***1 SCOPE**

1.1 This standard (Part 8) covers a method of test for determining the chemical resistance of the proper surface of all glazed ceramic tiles at room temperature.

1.2 The method is applicable to all glazed ceramic tiles except that the pencil test is only applied to glazes from which pencil marks can be removed by means of a dry cloth.

1.3 Where the pencil test is not applicable, the glazes can be classified by the change in appearance resulting from chemical action.

1.4 The stain test is not applicable tiles described as part glazed.

2 REFERENCE

The standard listed below is necessary adjunct to this standard:

<i>IS No.</i>	<i>Title</i>
2303 : 1994	Method of grading glass for alkalinity (<i>first revision</i>)

3 PRINCIPLE

3.1 For testing the resistance to staining, the test solutions are allowed to drop on and dry and then the test surfaces are inspected for visual changes.

3.2 For testing the resistance to household chemicals, swimming pool salts and citric acid, part of the glazed surface is subjected to the action of the test solution for 6 h and then inspected for visual changes.

3.3 For testing the resistance to hydrochloric acid and potassium hydroxide the procedure is similar except that the period of test is 7 days.

4 AQUEOUS TEST SOLUTIONS**4.1 Stains**

- a) *Methylene Blue*, 10 g/l, and
- b) *Potassium Permanganate Solution*, 10 g/l.

4.2 Household Chemicals

- a) *Ammonium Chloride Solution*, 100 g/l;

- b) Standard cleaning agent solution, prepared from:

- 1) Anhydrous sodium carbonate 33 percent (*m/m*)
- 2) Sodium perborate 7 percent (*m/m*)
- 3) Sodium silicate solution of density 1.33 g/cm³ 7 percent (*m/m*)
- 4) Commercial sodium oleate soap flakes 30 percent (*m/m*)
- 5) Distilled water or de-ionized water 23 percent (*m/m*)

- c) 100 g of this standard cleaning agent contain 70 g of dry substance. Use in a concentration of 10 g dry substance per litre. The test solution shall be prepared immediately before use.

NOTE — The soap can be prepared from concentrated sodium hydroxide solution and oleic acid in the proportion of 2.6 g to 18.5 g respectively.

4.3 Swimming Pool Salts

- a) Sodium hypochlorite solution 20 mg/l, prepared from technical grade hypochlorite with about 13 percent active chlorine.
- b) Copper sulphate solution, 20 mg/l.

4.4 Acids

- a) *Hydrochloric Acid Solution*, 3 percent (*v/v*) prepared from concentrated sulphuric acid ($d \approx 1.19$); and
- b) *Citric Acid Solution*, 100 g/l.

4.5 Alkali

Potassium hydroxide solution 200 g/l.

5 APPARATUS

5.1 **Vessel** — A cylinder of borosilicate glass conforming to Type 1 when graded according to IS 2303 or any other suitable material having a lid or an opening for filling. The bottom edge of the cylinder shall be ground flat and perpendicular to the vertical axis of the cylinder. Variations from the experimental

arrangement are permitted in order to accommodate different sizes.

5.2 Sealing Material

5.3 Cloth — White cotton or flax.

5.4 Pencil — HB hardness or equivalent.

5.5 Electric Lamp — 40 W, inside white (for example, siliconized).

6 TEST SPECIMENS

6.1 Size of Test Specimens

For testing according to 3.2, undamaged test specimens shall be used and they shall consist of either whole tile or parts of tiles.

6.2 Number of Test Specimens

Five test specimens shall be used with each test solution.

6.3 Preparation of Test Specimens

Thoroughly clean the proper surface with a suitable solvent, for example, methanol. Test specimens with surface defects shall be excluded from the test.

7 PROCEDURE

7.1 Application of Test Solution

7.1.1 Testing in Accordance with 3.1

Allow 3 or 4 drops of each of the test solutions specified in 4.1 to fall on a fresh part of the test specimen. Place an approximately 30 mm diameter convex watch glass on the applied drop in order to spread it to an approximately circular area. Allow to remain for 24 h and then rinse the surface with running water and wipe with a damp cloth. If a stain remains, thoroughly clean with a solution of the standard cleaning agent.

7.1.2 Testing in Accordance with 3.2

7.1.2.1 Apply a uniform layer of the sealing material 3 mm thick, to the rim of the cylinder. Turn the cylinder upside down onto a fresh part of the glazed surface as shown in Fig. 1 and seal around the rim.

7.1.2.2 Pour the test solution through the inlet to a height of 20 ± 1 mm maintain the test assembly at a temperature of $27 \pm 2^\circ\text{C}$.

7.1.2.3 For testing resistance to household chemicals, swimming pool salts and citric acid, maintain the test solution in contact with the test specimens for 6 h. Remove the cylinder and clean the glazed surface with a grease solvent.

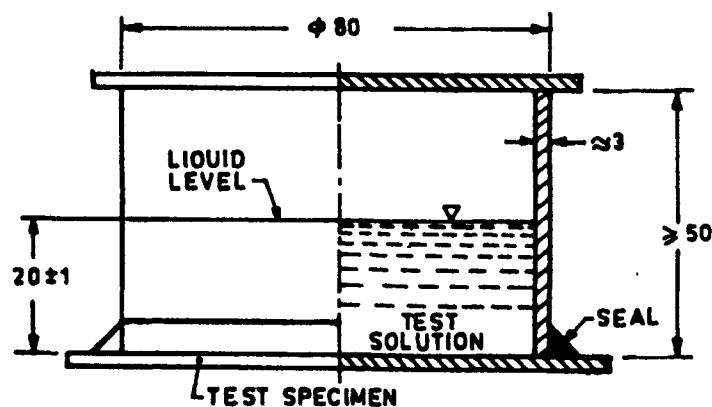
7.1.2.4 For testing resistance to hydrochloric acid and potassium hydroxide, maintain the test solution in contact with the test specimens for 7 days.

7.1.2.5 Shake the test assembly gently once in a day and ensure that the level of the test solution does not change. Replace the test solution after 4 days. After 3 more days, remove the cylinder and clean the glazed surface with a grease solvent.

7.2 Determination After Procedure in Accordance with 7.1.2

7.2.1 General

The surface that has been tested has to completely dry before assessment can commence. In order to assess whether the pencil test is applicable, draw several lines with an HB pencil on the untreated parts of the glazed surfaces and attempt to remove the marks with a dry cloth. If the pencil marks cannot be removed, the test specimens can only be assessed visually and the classification scheme of Fig. 2 is not applicable. For all other test specimens, the assessment shall be carried out according to 7.2.2 to 7.2.4.



All dimensions in millimetres.

FIG. 1 EXAMPLE OF AN EXPERIMENTAL ARRANGEMENT FOR THE TEST DESCRIBED IN 3.2

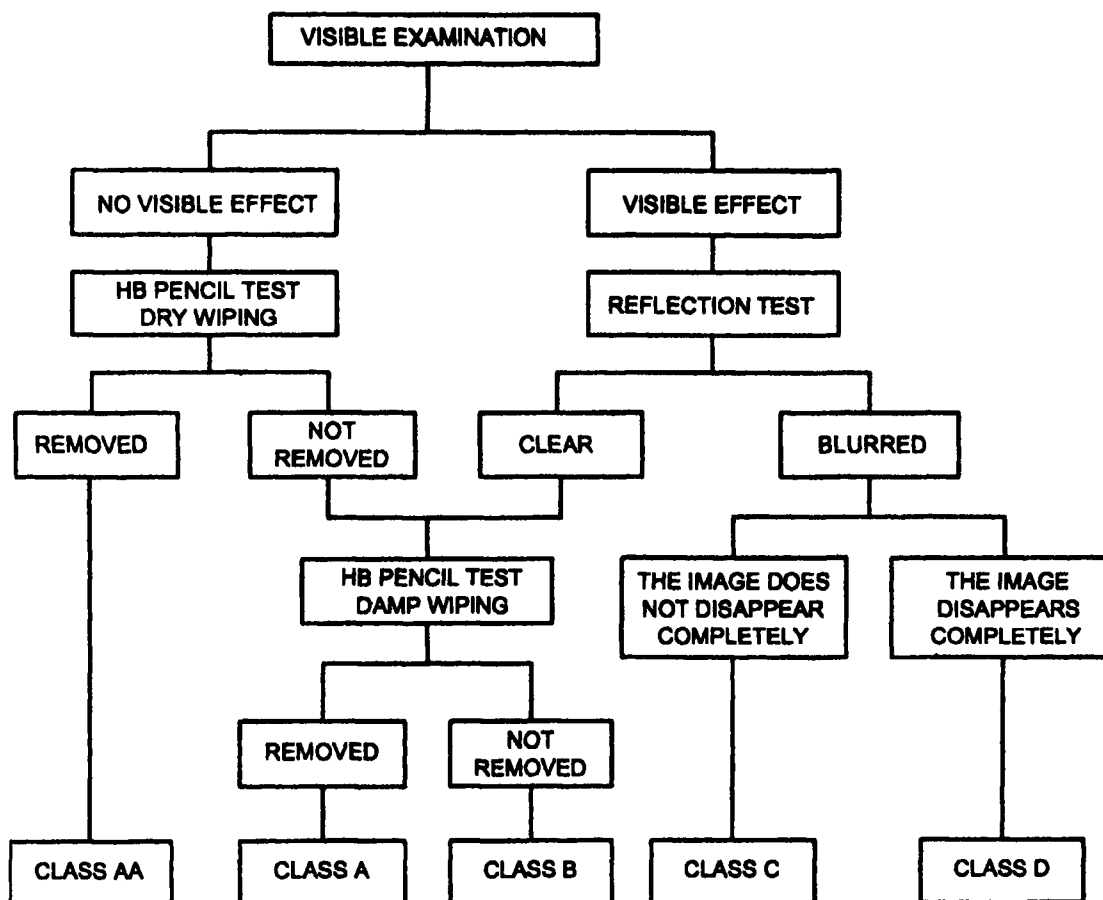


FIG. 2 CLASSIFICATION SCHEME FOR TESTS WITH HOUSEHOLD CHEMICALS, SWIMMING POOL SALTS, ACIDS AND ALKALIS

7.2.2 Initial Visual Examination

7.2.2.1 Examine the surface that has been tested from all angles from a standard distance of 250 mm with naked eye, with the aid of spectacles if usually worn, for any difference in appearance from an untreated surface, for example, for change in reflection or the development of brilliance.

7.2.2.2 The illumination is permitted to be artificial or daylight, but direct sunlight shall be avoided.

7.2.2.3 After examination, if there is no visible effect, perform the pencil test (see 7.2.3). If there is a visible effect, perform the reflection test (see 7.2.4).

7.2.3 Pencil Test

7.2.3.1 Draw several lines with an HB pencil both on the surface under test and on the untreated surface.

7.2.3.2 Attempt to remove the pencil lines by means of a soft dry cloth. If removed, the surface corresponds to Class AA. If not removed, attempt to remove the pencil lines by means of a soft damp cloth which has been dampened by dipping in distilled or de-ionized

water and then wringing out. If removed surface corresponds to Class A, if not removed to Class B.

7.2.4 Reflection Test

7.2.4.1 Hold the tile in such a manner that the image of the lamp is reflected on the untreated surface. The angle of incidence of the light upon the surface shall be approximately 45° and the distance between the tile and the light source shall be 350 ± 100 mm.

7.2.4.2 The criteria of judgment shall be the sharpness of the reflection and not the brightness of the surface. Position the tile so that the image fall simultaneously on both treated and untreated part and determine whether it is any less clear in the treated part.

7.2.4.3 This test cannot be applied to certain glazes, in particular, which are dull.

7.2.4.4 If the reflection is clear, perform the pencil test with damp wiping. If the lines are removed the surface corresponds to Class A; if not removed to Class B.

7.2.4.5 If the reflection is blurred, but does not

disappear completely, the classification is C and if the image disappears completely, the classification is D.

8 CLASSIFICATION OF RESULTS

8.1 Classification by Staining Test

8.1.1 In consequence of the procedure with stain solution, which has been performed in accordance with 7.1.1, glazes are divided into three classes given in Table 1. Record the result for each test specimen with each stain solution.

Table 1 Classification by Staining Test

Test Solution (1)	Observation (2)	Class (3)
Methylene blue	Stain removed by water	1
	Stain removed by cleaning agent	2
Potassium permanganate	Stain not removed	3

8.2 Classification by Testing with Household Chemicals, Swimming Pool Salts, Acids and Alkalis

8.2.1 Assessment in Accordance with Fig. 2

In consequence of the determinations with household chemicals, swimming pool salts, acids and alkalis performed in accordance with 7.1.2 glazes are divided into several classes as given in the scheme shown in Fig 2. Record the result for each test specimen with each test solution

8.2.1.1 Classes of resistance

AA = resistant,

- A = less resistant than AA but more resistant than B,
- B = less resistant than A but more resistant than C,
- C = less resistant than B, and
- D = not resistant.

8.2.2 Assessment not in Accordance with Fig. 2

In consequence of the determinations with household chemicals, swimming pool salts, acids and alkalis performed in accordance with 7.1.2 glazes are divided into several classes as assessed visually. These are glazes for which pencil test and/or reflection test are not applicable. Record the result for each test specimen with each test solution.

8.2.2.1 Classes of resistance

- AA = no visible effect,
- A = slight change in appearance,
- B = definite change in appearance,
- C = partial loss of the original surface, and
- D = total loss of the original surface.

9 TEST REPORT

The test report shall contain the following:

- a) Description of the tile;
- b) Test solutions used;
- c) Visual changes on the proper surface as a result of the test specified in 7; and
- d) Classification for each test solution and for each test specimen according to 8.

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Amendments Issued Since Publication

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